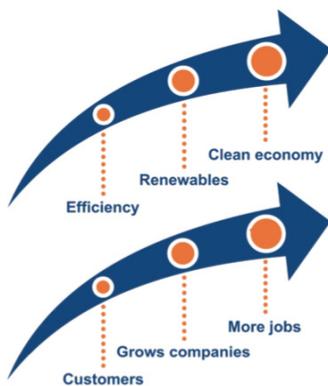
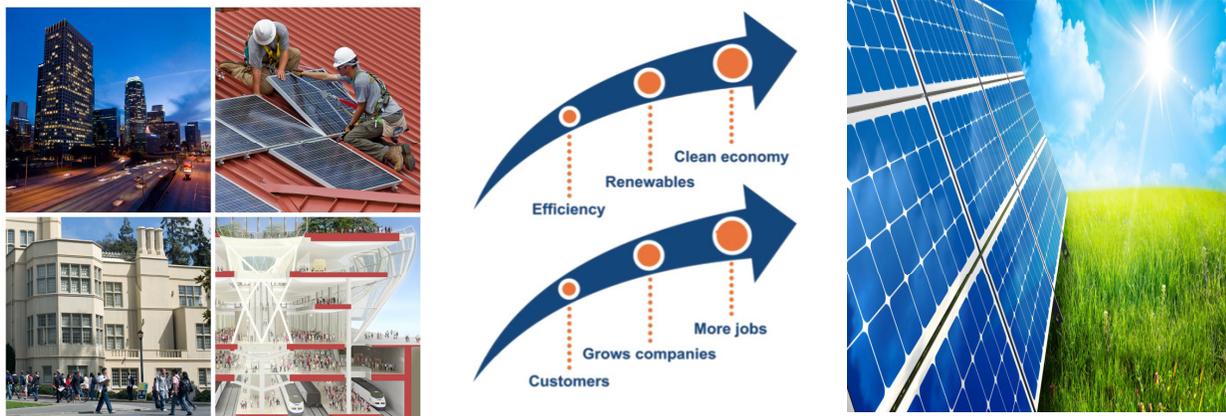


# Invest to Grow



## Investing AB 32 proceeds to grow California's clean and efficient economy

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# Executive Summary

California's total clean economy employs an estimated 308,000 people and results in over \$26 billion of economic output yearly.<sup>1</sup> Sectors that deliver reductions of greenhouse gases - clean energy, energy efficiency, clean transportation, energy storage, cleantech finance and investment, advanced materials and energy infrastructure - account for almost half of this important economic driver. Growth of these sectors continues to significantly outpace California's economy as a whole, providing new jobs and economic opportunities while delivering solutions that cut climate change pollution and save consumers money.

Targeted investments of AB 32 auction proceeds can act as a catalyst for even faster growth of California's clean and efficient economy. This report tells the story of the environmental and economic opportunity to invest AB 32 proceeds in solutions that facilitate this growth yet also cut climate change pollution. The opportunities discussed in this report include:

- ***Directly helping California businesses grow*** by investing in energy efficiency and clean energy retrofits for the industrial and commercial sectors.
- ***Investing in municipal projects*** that support local communities, improve air quality, and save taxpayers money.
- ***Improving transit and transportation*** options in the state that put Californians to work and make the air healthier to breathe.
- ***Making upgrades to K-12 schools, colleges, universities, and hospitals*** that create good-paying jobs and cut energy bills for local and state government, leaving more for education and healthcare.

Targeted investment of AB 32 proceeds offers California an opportunity to invest wisely in sectors of the economy that generate both economic and environmental benefits. Clean and efficient companies throughout California, from high efficiency window installers to LED manufacturers, are ready to supply even more manpower and technology that will enable the state to meet its greenhouse gas reduction targets while forging ahead on the path to sustained economic growth.

# Part I: Background and History

## ***California's legacy of innovative clean energy policies***

California is on the path to a clean and efficient economy. Since the early 1970s the state has deployed powerful clean energy and energy efficiency policies that have delivered billions of dollars in consumer savings and cut greenhouse gases across the economy. Key developments have included utility-scale investments in energy efficiency; unprecedented construction of renewable energy facilities; divestments from inefficient and polluting power plants; cutting edge codes and standards for buildings, appliances, and vehicles; large subsidies from the federal government; and the enactment of laws like Clean Car standards, the Emissions Performance Standard for power plants, the 33 percent RPS, and AB 32 (the Global Warming Solutions Act of 2006).

In addition to saving consumers money and cutting pollution, California's forward-thinking policies created an entire landscape of companies that provide the products and services to deliver clean energy and efficiency solutions. These companies are the backbone for continued growth of the clean and efficient economy and stand ready for the new opportunities that investment of AB 32 proceeds creates.

Despite California's continuous progress, significant opportunities for increased efficiency and deployment of clean energy exist throughout the industrial, residential, commercial, governmental, transportation, and power generation sectors. These opportunities involve individual businesses both large and small; municipal governments and communities; universities, schools and hospitals; land use planners and conservationists; builders and transportation system experts – just to name a few. Investing AB 32 proceeds wisely in these areas can unlock significant energy savings and deliver other important benefits for the state for years to come.

## ***California's economic challenges and the growth of key sectors***

The need for deployment of energy efficiency and clean energy solutions is compounded by the need for solutions that respond to the state's economic challenges. The state has confronted budget shortfalls since 2001, and the budget deficit is projected to exceed \$16 billion this year. The state has also encountered a lower-than-expected reduction in unemployment stemming from the 2010 economic recession: as of April 2012, California's unemployment rate was 11 percent – the third highest in the country.<sup>2</sup>

Despite these significant challenges, California has seen notable growth in sectors directly tied to the development of clean energy and energy efficiency solutions. Recently, EDF worked with Collaborative Economics to analyze and profile this growth, targeting the seven key sectors that provide the critical infrastructure to advance AB 32 goals of reducing greenhouse gas emissions while transforming the way business, government, and others use and produce energy.<sup>3</sup> These seven sectors include:

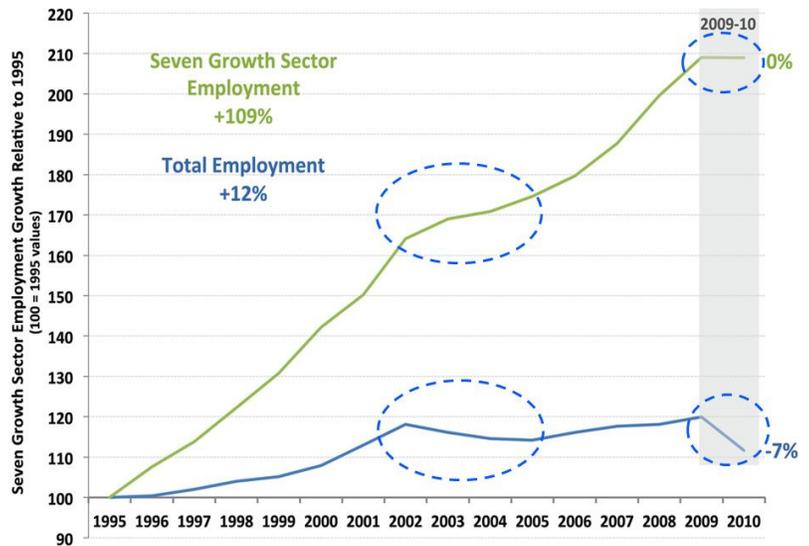
### SEVEN GROWTH SECTORS DRIVING CALIFORNIA'S CLEAN AND EFFICIENT ECONOMY

Sector	Activity of California companies operating within the sector	
<b>1. Energy Generation</b>	<ul style="list-style-type: none"> <li>• Renewable energy generation (all forms of solar, wind, geothermal, biomass, hydro, marine &amp; tidal, hydrogen, co-generation)</li> <li>• Research &amp; Testing in renewable energy</li> </ul>	<ul style="list-style-type: none"> <li>• Associated equipment, controls, and other management software and services</li> <li>• Renewable energy consulting services</li> </ul>
<b>2. Energy Efficiency</b>	<ul style="list-style-type: none"> <li>• Energy conservation consulting and software</li> <li>• Energy efficiency research</li> <li>• Building efficiency products (cables, glass, machinery etc.)</li> </ul>	<ul style="list-style-type: none"> <li>• Alternative energy appliances (solar heating, lighting etc.)</li> <li>• Energy efficiency meters &amp; measuring devices</li> </ul>
<b>3. Clean Transportation</b>	<ul style="list-style-type: none"> <li>• Alternative fuels (biodiesel, hydrogen, ethanol, fueling infrastructure)</li> <li>• Logistics (traffic monitoring software, transportation efficiencies)</li> </ul>	<ul style="list-style-type: none"> <li>• Motor vehicles &amp; equipment (electric, hybrid and natural gas, components and engines)</li> </ul>
<b>4. Energy Storage</b>	<ul style="list-style-type: none"> <li>• Advanced batteries (Li-Ion, Ultra Capacitors, Charging, Thin Film, Nickel Zinc)</li> <li>• Hybrid Systems (flywheels) and Uninterruptible Power supply</li> </ul>	<ul style="list-style-type: none"> <li>• Fuel cells (methanol, PEM, solid oxide, zinc air, systems integrators)</li> <li>• Battery components &amp; accessories</li> </ul>
<b>5. Finance &amp; Investment</b>	<ul style="list-style-type: none"> <li>• Investment Advisory, asset management and brokerage</li> </ul>	<ul style="list-style-type: none"> <li>• Project financing &amp; insurance</li> <li>• Emission trading and offsets</li> </ul>
<b>6. Advanced Materials</b>	<ul style="list-style-type: none"> <li>• New materials for improving energy efficiency</li> <li>• Nano (additives, detectors, sensors, gels, coatings, lubricants, films)</li> </ul>	<ul style="list-style-type: none"> <li>• Chemical (composites, polymers)</li> <li>• Bio (advanced processes, biodegradable products etc.)</li> </ul>
<b>7. Energy Infrastructure</b>	<ul style="list-style-type: none"> <li>• Transmission (smart grid, sensors &amp; concerns)</li> </ul>	<ul style="list-style-type: none"> <li>• Power management, monitoring, metering, quality and testing</li> </ul>

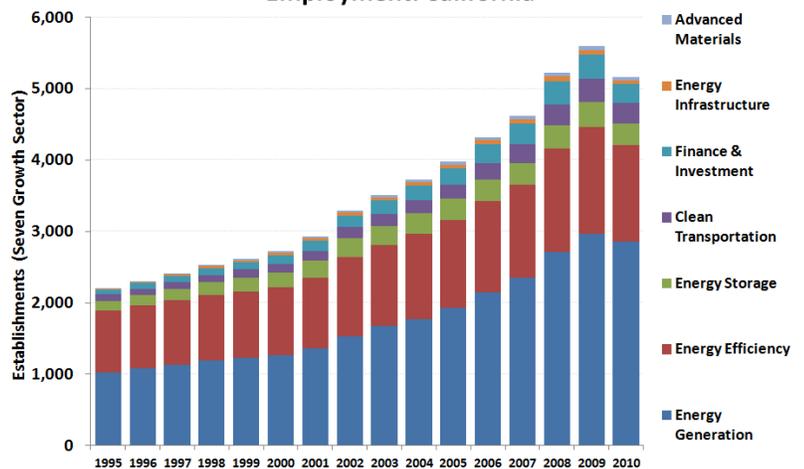
The clean energy policies California has put in place have been delivering results for the state economy and creating jobs for years. As shown by Collaborative Economics, the seven clean and efficient sectors most closely related efforts that cut greenhouse gases has grown rapidly since the 1990s, consistently outpacing the growth of the overall California economy.

During the recent economic recession, these seven sectors showed greater resilience in terms of employment stability than the economy as a whole. In the last observable year, statewide employment fell seven percent, while jobs in the seven sectors remained stable, maintaining their employment level from the year before. From January 1995 to 2010 the statewide employment in the seven sectors more than doubled (an increase of 109 percent), while jobs in the overall California economy expanded by 12 percent.

Employment Growth Relative to 1995: California



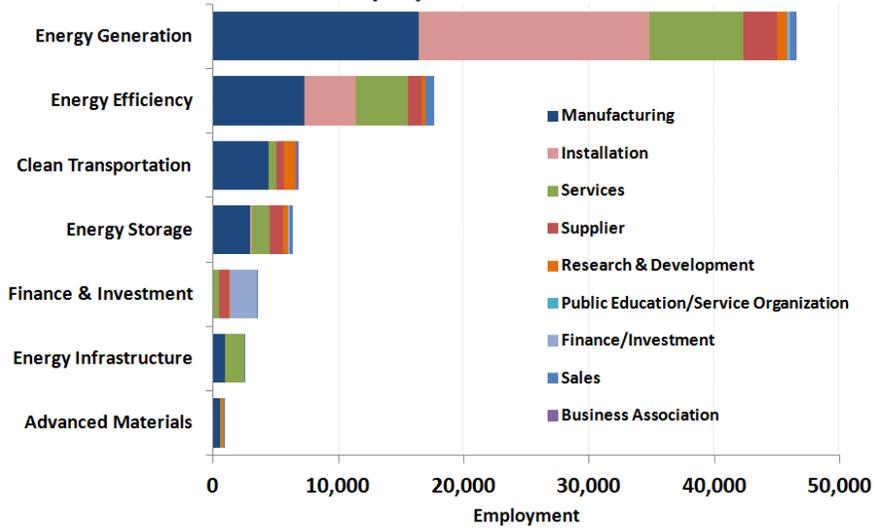
Seven Growth Sectors Driving California's Clean & Efficient Economy  
Employment: California



Source for both graphs above: Collaborative Economics. Seven Sectors Report, May 2012.

Conservatively, Collaborative Economics has estimated that the seven sectors of the clean energy and efficiency currently represent more than 90,000 jobs in the state.<sup>4</sup> Other estimates from Environmental Business International (123,000 jobs)<sup>5</sup> and the Brookings Institution (111,000 jobs)<sup>6</sup> put this number higher. The two largest sectors in California's clean and efficient economy – clean energy generation and energy efficiency – are comprised of nearly two-thirds installation and manufacturing. Jobs.<sup>7</sup> Accordingly, it is clear that California companies are able to provide the products, services and manpower demanded by other in-state businesses seeking emissions reductions and efficiency solutions.

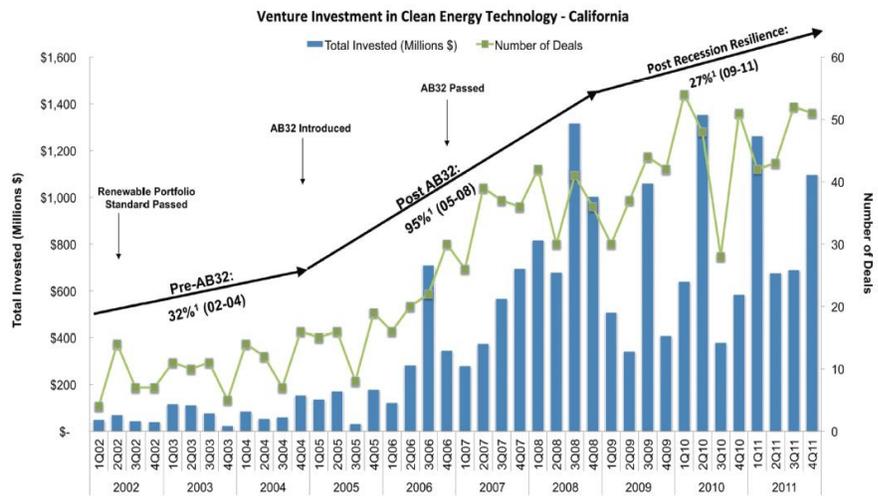
**Seven Growth Sectors Driving California's Clean & Efficient Economy**  
**Value Chain Employment: California 2010**



Source: Collaborative Economics. Seven Sectors Report, May 2012.

In addition to generating jobs, California firms also leaders in clean technology innovation, which is bolstering state exports. Between 2002 and 2011, California accounted for almost 9 percent of worldwide clean energy patents.<sup>8</sup> Further, in 2010 alone, clean energy sectors created \$16,314 of export value per job versus \$10,390 of export value per job for the overall economy.<sup>9</sup> And in 2011, California accounted for 13 percent of all “environmental goods” exported by the U.S., with the majority of those goods in renewable or efficiency products or services.<sup>10</sup>

Even in difficult economic times, the products and services of companies in these growth sectors had sufficient market demand to continue to attract large new investments. Since 2009, venture capital investment has experienced almost 30 percent growth,<sup>11</sup> an increase likely tied, in part, to implementation of AB 32 and other state policies.



Source: Cleantech Group's i3 Platform

## ***Examples of homegrown companies providing solutions in the key sectors***

California firms engaged in the seven key growth sectors are located throughout the state and are well positioned to help businesses, institutions, and individuals implement solutions that cut their energy use, save money, and meet the goals of AB 32. These businesses provide the products and services needed to retrofit homes and schools, build new renewable energy facilities, and install state of the art energy saving technology. Since most of relevant work in manufacturing, installing, and retrofitting cannot be exported, the businesses that drive the clean and efficient economy are here to stay.

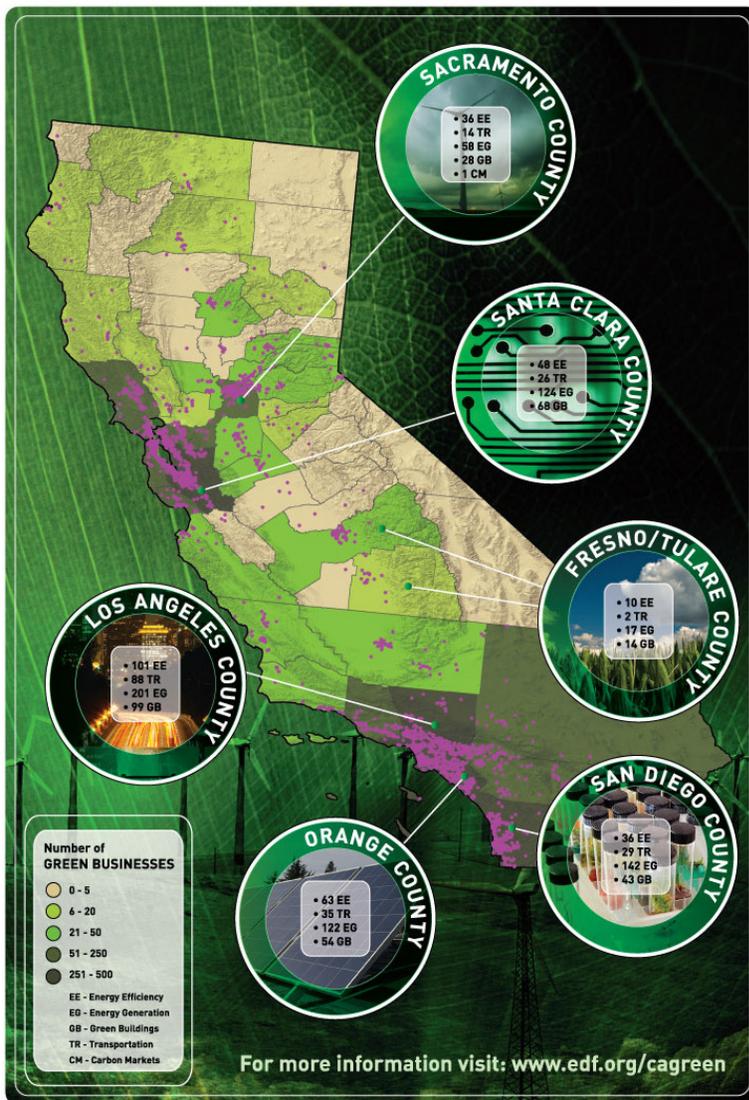
California businesses involved in manufacturing, installation and retrofitting are associated with a wide range of products and services like wind energy; LED lighting; high-efficiency windows and other building materials; rail; and lithium-ion batteries.

### Sample Firms Driving California's Clean and Efficient Economy

<b>Company</b>	<b>Sector</b>	<b>Description</b>	<b>Employees*</b>
<b>OSRAM Opto Semiconductors</b>	Advanced Materials	LED Manufacturing	3,500
<b>KLA-Tencor</b>	Advanced Materials	LED Manufacturing	6,000
<b>LEDtronics</b>	Advanced Materials	LED Manufacturing	300
<b>Zenergy Power</b>	Advanced Materials	Transmission Technology	25
<b>Siemens</b>	Clean Transportation	Passenger Rail Coach Construction	405,000
<b>Kontron AG</b>	Clean Transportation	Rail Driving Control Systems	163
<b>AeroVironment</b>	Clean Transportation	Electric Vehicles	750
<b>Philips Lumileds</b>	Energy Efficiency	LED Lighting	220
<b>Davis Energy Group</b>	Energy Efficiency	Building efficiency consultancy	20
<b>Evergreen Engineering</b>	Energy Efficiency	Green Building	51-200
<b>Advantech</b>	Energy Generation	Computing Platforms	1,360
<b>GE Wind Energy</b>	Energy Generation	Wind Turbines	322,980
<b>Ameron</b>	Energy Generation	Wind Towers	2,800
<b>First Wind</b>	Energy Generation	Wind Power	155
<b>BrightSource</b>	Energy Generation	Solar	400
<b>International Solar Electric Technology</b>	Energy Generation	Solar	11
<b>Atmel</b>	Energy Storage	Lithium-ion Battery Management	5,600
<b>Intersil</b>	Energy Storage	Lithium-ion Battery Management	1,503

\*As of September 2009. Source: Duke Center on Globalization, Governance & Competitiveness

From 2008 to 2011, the Duke University Center on Globalization, Governance and Competitiveness, with assistance from EDF and labor groups, analyzed the value chains behind different products and services in the seven clean and efficient sectors.<sup>12</sup> This work identified firm locations along the value chain in order to better understand which states can benefit from growth in demand for clean energy products and services. When coupled with corroborating data from Collaborative Economics, the report clearly demonstrates that California manufacturing and service firms are ready to provide the products and services that will be in increasing high demand as further investments to reduce emissions and conserve energy are made.



In addition to the Duke work, EDF has profiled over 5,000 companies and identified job opportunities throughout the state in the clean economy. This work has yielded findings similar to that of Duke- that a broad spectrum of companies are located up and down the state and are ready to provide the products and services necessary to propel California into a 21<sup>st</sup> century clean and efficient economy.

These results can be found at [www.edf.org/cagreen](http://www.edf.org/cagreen)

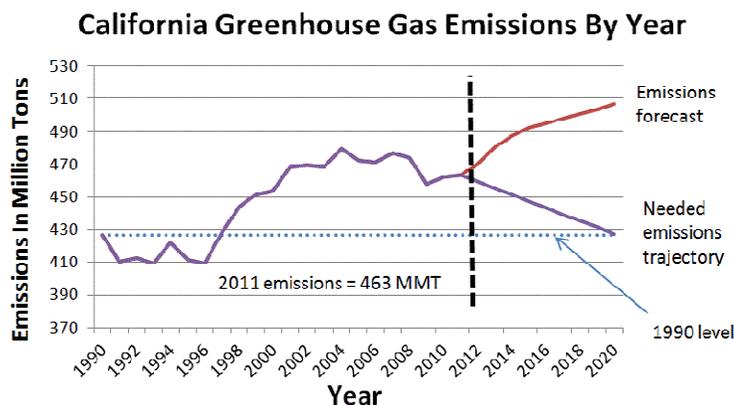
## Part II: The Need for AB 32 Investments

Targeted investment of AB 32 proceeds can catalyze even greater growth of California's clean and efficient economy and deliver a new wave of customers to California businesses operating in these sectors. Furthermore, since many investments in clean technology solutions; retrofits and efficiency upgrades; and clean energy installation use California companies, money that is put into these solutions is actually recycled throughout the state's economy - creating a multiplier effect for economic benefits.<sup>13</sup> In addition to bolstering California's economy, AB 32 investments can also reduce air pollution, fill gaps created by reduced state and federal funding, accelerate energy independence, and save businesses money. As detailed in Part III of this report, investing in industrial and commercial businesses; municipal governments; colleges and universities; schools; hospitals; and the transit and transportation sector most clearly meets the need and delivers the benefits described.

### ***Cutting pollution to protect Californians***

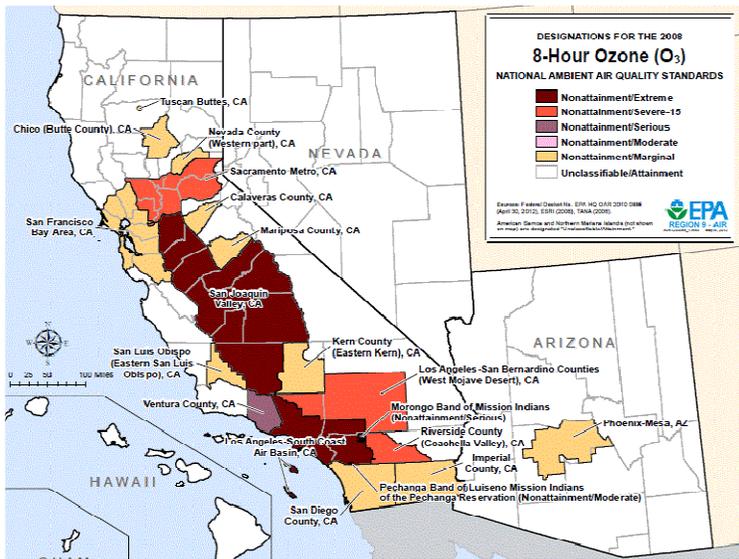
In 2006, California set an ambitious greenhouse gas emissions reduction goal of returning to 1990 emissions levels by 2020. To achieve this target, California must reduce emissions by about 20 percent below projected emissions levels in 2020, achieving an emission rate of 427 million metric tons of carbon dioxide equivalent.<sup>14</sup>

In the long term, the state aims to reduce greenhouse gas emissions 80 percent below 1990 levels by 2050. Aggressively investing in energy efficiency and clean energy solutions using AB 32 funding can help cut climate change pollution sufficient to meet this goal.



Source: CARB Emissions Forecast (Oct. 2010)

Efforts to cut greenhouse gas emissions in many cases also reduces harmful co-pollutants that acutely threaten public health.<sup>15</sup> California must reduce these pollutants to meet federally- mandated standards for air quality. As of March 2012, at least 38 of 58 counties in California were in non-attainment for at least one criteria air pollutant as determined by the U.S. EPA.<sup>16</sup> Investments of AB 32 proceeds will provide much-needed co-benefits for public health and air quality.



Source: U.S. EPA

Smog-related ground level ozone concentrations (left) are just one example of the air quality problems California faces. Non-attainment with federal standards for this pollutant is associated with increased risk of mortality. Children and elderly populations are most vulnerable to health impacts.

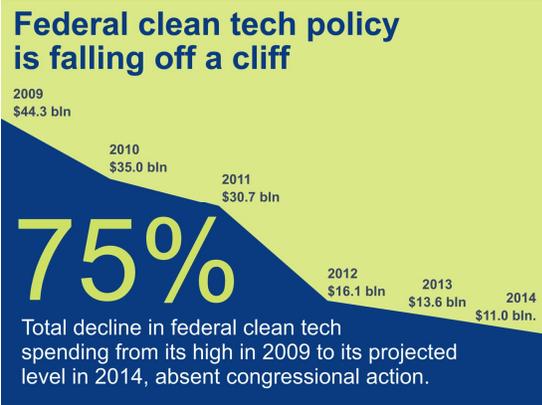
Particulate matter (PM) offers another example of the harmful impacts of air pollution in California. A recent study found that PM, primarily emitted from power plants and diesel engines, causes 130,000 premature deaths, 110,000 emergency room visits due to asthma, and 18,000,000 lost workdays due to illness in the United States annually.<sup>17</sup> Los Angeles is among the cities with the highest estimated rate of premature deaths due to particulate matter and ozone air pollution in the country.

#### Health Impacts of Five Criteria Air Pollutants Currently Emitted in California<sup>18</sup>

Pollutant	Sources	Health Effects
<b>Carbon Monoxide</b>	Motor vehicle exhaust, wood burning stoves	Headaches, cardiovascular disease, heart attack, impaired fetal development, death
<b>Sulfur Dioxide</b>	Coal-fired power plants, petroleum refineries, other industrial sources	Lung damage, shortness of breath, wheezing, eye irritation
<b>Nitrogen Dioxide</b>	Motor vehicles, electric utilities, other industrial and commercial sources	Respiratory infections, irritation of lung and respiratory systems
<b>Ozone</b>	Motor vehicle exhaust, other fumes	Eye and throat irritation, respiratory tract problems, asthma, lung damage
<b>Particulate Matter</b>	Diesel engines, power plants, other industries	Asthma, bronchitis, eye irritation, lung damage, cancer, heavy metal poisoning, cardiovascular damage.

# State and federal budget constraints

In light of the severe state budget crisis and continued high unemployment, numerous opportunities to reduce energy consumption, expand renewables, and invest in clean transportation are currently unfunded.



Source: Brookings Institution, Beyond Boom and Bust: Putting Clean Tech on a Path to Subsidy Independence, 2012

In the clean energy arena, drastic cuts in state and federal funding have become commonplace. In fact, federal clean technology investment is expected to plummet 75 percent from 2009 to 2014. As a result, California cannot reasonably rely on federal funding to be the driving force behind the clean economy growth. AB 32 revenue offers an opportunity to make up the shortfall in state and federal funding and deliver new customers to clean technology companies.

In addition to diminished funding for clean technology, other sectors face significant budget shortfalls. For example, in the transit sector, the California Transit Association identified over \$42 billion in unmet capital investment need for projects over the next 10 years – much of which is easily traced to reductions of greenhouse gases. Given state budget projections, existing transit systems will face a \$22.2 billion shortfall over the next 10 years.<sup>19</sup> Accordingly, AB 32 proceeds could be a crucial source of money for unfunded and underfunded projects to move forward.

Funding for Transit Project in California, fiscal year 2011-2020

Funding Type	Funding Need (10 yr)	Funding Trend (10 yr)	Funding Gap (10 yr)
Operating Funding operations, maintenance	\$109.7 billion	\$87.5 billion	\$22.2 billion
Capital Funding equipment, new purchases	\$79.2 billion	\$30.9 billion	\$42.1 billion

Source: Grant, Y. and Shaw, J. April 2012. Unmet Transit Funding Needs in California: FY2011-2020. Ninth National Conference of Transportation Asset Management.

## ***Accelerating energy independence***

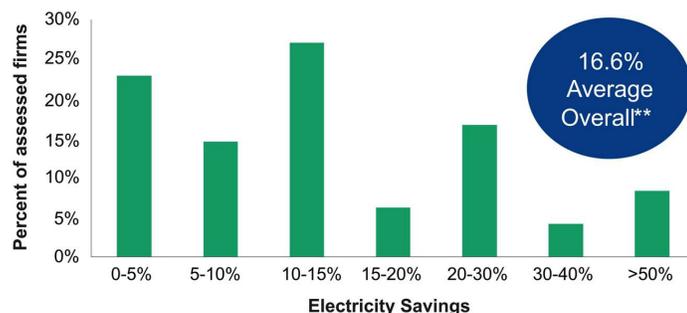
Investing in solutions to reduce greenhouse gases decreases California's dependence on foreign energy imports, in particular gasoline. Fifty percent of the crude oil in California comes from foreign sources, which gives California a high level of energy insecurity despite the fact that the state leads the country with its investments in renewables.<sup>20</sup> In fact, California spends between \$20 and \$40 billion every year on imported fossil fuel. This reliance on imported fuels makes California drivers vulnerable to political instability abroad and susceptible to fuel price swings outside the control of domestic policies. Targeted investments to increase California's energy independence – for example throughout reduced gasoline consumption by the existing automotive fleet – will reduce the impacts and risks of fluctuating energy prices.

## ***Untapped investment and savings potential***

Sectors across the state have tremendous untapped opportunity for energy savings and job creation. Despite the fact that efficiency programs have targeted many large industrial businesses in the past, an enormous potential for energy savings still exists.

In the industrial sector, the Department of Energy Industrial Assessment Center identified an average of 17 percent electricity savings opportunity per firm in audits conducted on 48 firms in 2010 and 2011.<sup>21</sup> Notably, in 2006, the Industrial Assessment Center identified an average of only 13.6 percent energy savings opportunity per firm: meaning manufacturing firms are identifying more savings now than in 2006.

Potential Energy Savings per Firm Audited by US DOE in California in 2010 and 2011



Source: Industrial Assessment Center Database

In a recent interview, Ahmad Ganji, Ph.D., Director of the San Francisco State University Industrial Assessment Center sponsored by U.S. Department of Energy, explained why many opportunities still exist:

*“Despite progress to date, California manufacturers still have a vast number of significant, untapped energy efficiency opportunities. We know this because every industrial assessment audit completed by our team identifies energy saving opportunities, and we’ve only audited a small number [about 420 total] of California manufacturing firms in Northern and Central California. We’re finding just as many savings today as 5 years ago, partially due to new knowledge and partially due to new technologies. Energy efficiency has proven to be a continuous improvement process. In one of our recent audits, we identified and recommended 18 energy efficiency opportunities that could result in 15% decrease in the plant’s energy cost, and with less than one year payback.”*

– Ahmad Ganji, Ph.D., Mechanical Engineering Program Head, Professor of Mechanical Engineering, and Center Director, San Francisco State University Industrial Assessment Center

Sample options for Energy Efficiency identified by DOE’s California Industrial Assessment

Eliminating air and steam leaks	Insulating bare equipment
Using multiple speed motors	Installing occupancy sensors
Establishing a burner maintenance schedule for boilers	Reducing pressure of compressed air to minimum requirement

California’s commercial sector may offer even greater untapped energy efficiency prospects. For example, in a May 2012 decision during the review of the California utility long term energy efficiency plans, the California Public Utilities Commission reported that small commercial buildings (< 200 kW / month usage) have been virtually untouched by efficiency programs. In one example, the Commission found that although medium-size commercial businesses represent over 90 percent of a particular portion of Southern California Edison’s and San Diego Gas and Electric’s customer base, on average less than three percent participated in energy efficiency programs.<sup>22</sup>

Similarly, EDF’s Climate Corps program, which tasks MBA and MPA students with finding energy savings in businesses and public sector entities across the country, has demonstrated the kinds of savings found in California’s commercial spaces. In just 14 California companies evaluated between 2008 and 2011, Climate Corps participants identified potential savings of over \$13 million and tens of thousands of tons of CO<sub>2</sub>.<sup>23</sup> However, Climate Corps also observed that companies often defer implementation of options that exceed a two-year payback period. Accordingly, a modest amount of financial assistance has been found to change the payback period for a project and accelerate implementation of energy-saving opportunities.

## Examples of Potential Savings Identified by California EDF Climate Corps Fellows

Company	Facility Type	Annual cost savings	Annual CO <sub>2</sub> savings (tons)	Annual Electricity savings (kWh)
<b>Advanced Micro Devices - 2009</b>	Office building			512,000
<b>Cisco - 2009</b>	Data center	\$1,800,000		18,000,000
<b>eBay - 2010</b>	Data center		5,000	7,000,000
<b>Facebook - 2011</b>	Office building		5,000	
<b>Hewlett Packard - 2009</b>	Data center		650	2,000,000
<b>Intuit - 2008</b>	Office building	>\$500,000		
<b>Intuit - 2009</b>	Office building	\$400,000		2,600,000
<b>Shorenstein Properties - 2011</b>	Office building	\$120,000		
<b>Sony Picture Entertainment - 2009</b>	Data center		900	3,000,000

Source: Public EDF Climate Corps data available at <http://edfclimatecorps.org/organizations>.

Across many sectors, lack of access to capital is a major barrier to retrofits, clean energy installations, and other energy saving projects. This year, the Institute for Building Efficiency surveyed 1,139 executives and building owners responsible for building energy management and investment decisions in the U.S. and Canada.<sup>24</sup> The obstacle to energy efficiency improvements most frequently cited by executives is available capital – 37 percent of respondents said it is the top barrier. AB 32 proceeds invested in financial assistance programs linked to energy efficiency can help firms and governments access savings and reinvest in the state economy.

## Part III: Recommendations for Investment<sup>25</sup>

Targeted investments of AB 32 proceeds are needed to jumpstart investments in key areas that will create jobs, cut harmful pollution, and help California continue to lead the country in clean technology innovation and manufacturing. The industrial sector, commercial sector, municipal governments, universities, schools, hospitals, and transportation and transit are all areas where smart investments can reap enormous benefits. These areas each have considerable unmet need and AB 32 investment can unlock energy savings, pollution reduction, and economic growth for California.

### **Directly helping California businesses grow**

#### ***Investing in industrial energy efficiency***

AB 32 regulates large industrial facilities' emission. Making money available for energy efficiency and clean energy financing can help firms reduce compliance costs, overcome capital access barriers, and drive additional reductions. In addition, in many situations providing financing to California businesses to make efficiency improvements recycles money back into the state and supports the businesses in the clean economy.

Proceeds from AB 32 could also be crucial to unlocking industrial sector energy savings because of high capital costs. Industrial retrofits require large upfront investments. A study commissioned by the California Public Utilities Commission last year estimated that a 25 percent reduction in California's industrial energy consumption would cost \$2 billion in installation costs.<sup>26</sup> Firms often have trouble sourcing capital for these improvements despite their long term cost-savings.

At a conference hosted last year by the California Energy Efficiency Industry Council, energy efficiency, financing, and policy experts identified several challenges of working with financial institutions on energy efficiency projects, including the following:

- Financers do not adequately understand efficiency projects and associated risks
- It can be difficult to aggregate projects for private equity markets<sup>27</sup>
- The cost of retrofit projects is frequently too small for lenders<sup>28</sup>

However, despite financing challenges noted by the Council, industries remain eager to make use of available funding for efficiency improvements. As evidence response to the Institute for Building Efficiency's 2012 survey, 42 percent of executives said tax credits,

incentives, and rebates are the biggest policy driver for decisions to undertake energy efficiency projects.<sup>29</sup> AB 32 revenue can fill this gap to invest in energy savings and reduce pollution.

## ***Investing in non-industrial commercial energy users***

AB 32 proceeds could provide the resources to implement programs needed to engage the state's commercial entities and reduce greenhouse gases. In the U.S., commercial buildings account for 19 percent of energy consumed – and more than half of this energy is used for heating and lighting.<sup>30</sup>

Research by EDF Climate Corps fellows has demonstrated tremendous energy saving opportunities in office buildings, data centers, and other commercial buildings across the country. The fellows have clearly illustrated the cost savings associated with saving energy. Since 2008, EDF Climate Corps fellows have identified efficiencies in lighting, computer equipment, and heating and cooling systems that could save \$1 billion in net operational costs over the project lifetimes, cut the energy usage to power 100,000 homes annually, and avoid the CO<sub>2</sub> emissions of 200,000 cars each year.

For example, a summer fellow at AT&T in 2010 identified lighting as a major area of energy use for the company's office buildings. The fellow determined that lighting in offices was on 50 percent of the time, while office spaces were occupied on average 10 percent of the time. As an outcome of her project, this fellow recommended occupancy sensors for lighting in AT&T's central offices across the country, estimating that installing these lighting sensors would result in 80 percent savings in lighting system energy use. Retrofitting lighting in more than 100 million square feet of office space could save hundreds of millions of kWh annually. Another fellow working at the real estate firm Shorenstein Properties identified an opportunity for thermal energy storage at a Shorenstein property in Southern California. He found that by chilling stored water during off-peak hours, the property would save \$120,000 in annual electric energy cost.

Another area of opportunity identified by EDF Climate Corps is energy savings in multi-tenant buildings. This opportunity was also reported by the California Public Utilities Commission with recommendations for the state to implement incentive programs to increase the installation of sub-meters, plug load control technologies, and energy management systems.<sup>31</sup>

Despite the clear advantages of cutting cost, energy, and pollution, these changes require employee time and capital to identify and implement potential savings. AB 32 proceeds

could provide direct loans and other incentives to allow commercial entities to fully integrate energy savings into their business plans. This strategy will in turn result in companies performing more, targeted, energy audits and following through on findings by undertaking retrofits and implementing energy-saving measures that pay back over time.

## **Supporting local communities**

### ***Investing in municipal efficiency***

California’s municipal- and state-owned buildings and structures provide another important investment opportunity to improve air quality and cut local budgets to save taxpayers money. Savings that result from upgrading and retrofitting municipal buildings permanently reduce city expenditures on fuel and electricity, a direct benefit to municipal budgets. EDF Climate Corps data and interviews with California municipal government representatives demonstrate the huge emission and cost savings in municipal buildings and operations in cities and counties across the United States. The five municipal projects representing the largest greenhouse gas emission reductions are:

Examples of Energy Efficiency Opportunities Identified by EDF in Cities and Counties

<b>Project</b>	<b>5-year CO<sub>2</sub> Reductions (tons)</b>	<b>5-year Cost Savings</b>	<b>Capital Investment</b>	<b>Net Present Value</b>	<b>Average Payback (years)</b>
<b>NYC Housing Authority, New York</b>	930,000	\$290,000,000	\$217,000,000	\$457,000,000	2.00
<b>Mecklenburg County, North Carolina</b>	6,700	\$970,000	\$730,000	\$660,000	3.80
<b>Middletown, New Jersey</b>	3,600	\$1,000,000	\$340,000	\$830,000	2.20
<b>New Hanover County, North Carolina</b>	3,300	\$500,000	\$38,000	\$440,000	1.20
<b>Cary, North Carolina</b>	3,200	\$2,200,000	\$1,800,000	\$1,600,000	4.0
<b>Total</b>	946,800	\$294,670,000	\$219,908,000	\$460,530,000	

Source: Public EDF Climate Corps data available at <http://edfclimatecorps.org/organizations>.

Beyond the projects with the largest pollution reductions, Climate Corps has identified many smaller-scale improvements that produce major benefits. For example, in the city of Atlanta, Climate Corps fellows worked to improve the energy efficiency of city fire stations. The team recommended projects across the city’s 17 fire stations that included temperature setbacks, increased use of natural lighting, installation of occupancy sensors, ceiling and HVAC insulation, and replacement of single pane windows with double-pane windows. The proposed projects would save more than \$90,000 annually, save one million kWh, and avoid 550 metric tons of carbon emissions.

Options for Municipal Energy Savings Identified by EDF Climate Corps

Lighting Timers	LED Exit Signs
Install occupancy sensors	Upgrade boilers, HVAC, building systems
Insulate water heaters	Outsource boiler plant maintenance
Apply weather stripping	Improve ceiling insulation
Delamp vending machines	Install low flow water systems
Perform LED lighting retrofit	Upgrade appliances
Perform thermostat setback	Switch from incandescent to CFL bulbs
Install window film	Install automated thermostat controls

Source: EDF Climate Corps data and <http://edfclimatecorps.org/organizations>.

AB 32 proceeds could be key to unlocking these types of taxpayer savings while also supporting local communities.

One specific short-term opportunity for local governments and communities in California is funding to improve street lighting, which contributes up to 60 percent of municipalities’ electrical bills and one percent of the state’s total energy use.<sup>32</sup> More than 76 percent of streetlights surveyed recently by UC Davis still use high-pressure sodium lamps, which consume roughly twice as much energy as more advanced lighting options.<sup>33</sup> In addition to using less energy, advanced street lamps are more durable, can provide more aesthetic and softer looks, and contribute to public safety by significantly increasing visibility.<sup>34</sup>

Since ownership of street lighting systems is typically centralized, many cities could act swiftly to make the upgrades needed to lower their bills and emissions. However, one of the most commonly cited obstacles to retrofit projects is finance.<sup>35</sup> This combination of factors makes street lighting upgrades an ideal candidate for AB 32 proceeds investment. In addition to emission and cost reductions, these infrastructure projects would provide jobs to Californians at all points along the manufacturing and installation pipeline. Eighty-three of the U.S.’s LED supplier firms are found in California, more than in any other

state.<sup>36</sup> The spike in demand that would flow from municipal upgrades could help California further assert itself as the leader in the modern lighting industry.

## **Better transit and transportation**

Targeted investments in innovative transportation policies can reduce the carbon intensity of the sector as a whole, thereby achieving large reductions in greenhouse gas emissions and growing the economy. In addition to cutting greenhouse gas emissions, decreased fossil fuel combustion can reduce risk to public health and the environment to put California on the path to attainment of federal air pollution standards.

In California, the transportation sector accounts for 38 percent of CO<sub>2</sub> emissions and significant levels of particulate matter, carbon monoxide, nitrogen dioxide, and other dangerous co-pollutants, the bulk coming from passenger automobiles. A 2010 study found that exposure to motor vehicle air pollution exacerbates childhood asthma and may also be related to other non-asthma respiratory problems, such as cardiovascular disease, and impaired lung function.<sup>37</sup> Taking steps to reduce greenhouse gas emissions in California improves public health outcomes and reduces illnesses and associated medical expenditures in the state by reducing dangerous co-pollutants.

Despite considerable progress in developing an innovative, low-carbon transit system, California faces enormous unmet funding needs for both new and existing projects across the state, from commuter rail to new HOV lanes. However, funding such projects creates jobs as well as cutting pollution. For example, in public transit, every \$1 billion invested in new projects supports 24,000 jobs annually, while every \$1 billion used for existing public transit systems supports or retains 41,000 jobs.<sup>38</sup> For more traditional transportation infrastructure, the Federal Highway Administration estimated in 2007 that a \$1 billion expenditure on highway construction supported a total of 30,000 jobs, including 10,300 construction-oriented jobs, 4,675 jobs in supporting industries, and 15,094 induced jobs.<sup>39</sup> These projects include congestion relief improvements and adding HOV lanes, both of which cut greenhouse gases by eliminating traffic, cutting driving times, and increasing carpooling.

There are many innovative policy options for investing in transit and transportation options throughout California, from expanding public transit systems to improving the efficiency of vehicles. *Reinventing Transit*, a 2009 EDF report, highlighted some of these opportunities by evaluating the accomplishments of King County, Los Angeles and other California communities to develop innovative transit systems that provide affordable, reliable transportation options.<sup>40</sup> Similarly, *Moving Cooler*, an analysis of transportation

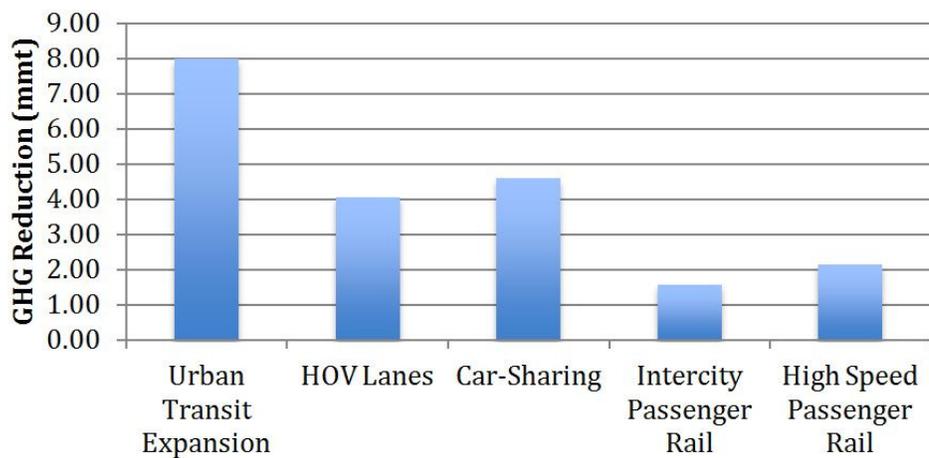
strategies for reducing greenhouse gas emissions by the Urban Land Institute in 2009 identified a suite of options for the transit and transportation sector.<sup>41</sup>

### **Key Investment Ideas Identified for California’s Transportation Sector in Reinventing Transit and Moving Cooler Reports**

- Investing in public transit system expansion and improvement to connect more riders to innovative transit options
- Investing in multimodal transportation systems that give travelers more options—including walking and bicycling
- Investing in upgrading to a cleaner, more efficient vehicle fleet through innovative technologies and targeted regulations
- Investing in smart growth strategies that reduce the distances traveled and improve accessibility and efficiency in communities
- Investing in public education about ecodriving and other fuel-efficient driving strategies

In addition to strategies outlined in *Reinventing Transit* and *Moving Cooler*, efforts like SB 375 implementation and Sustainable Community Planning processes have identified measures that reduce pollution and increase the overall efficiency of the transit and transportation sector. These measures include the integration of transportation system improvements and modifications into local and regional plans – resulting in an evaluation of investments in an integrated manner for the purpose of achieving larger overall reductions. This coordinated approach to transportation system investments – on a regional scale – is another important focus for AB 32 revenue investment and has the potential to result in larger, longer-term reductions that place California on a path toward a low carbon economy.

## GHG Reduction by 2020



Scenarios modeled with aggressive deployment of these transportation options.

Source: Cambridge Systematics. Moving Cooler, 2009 and EDF. Reinventing Transit, 2009.

In addition to cutting greenhouse gas emissions, investments in innovative transportation policies can generate cost savings that exceeded implementation costs by up to \$112 billion over 40 years.<sup>42</sup>

### **Making upgrades to K-12 schools, colleges and universities and hospitals**

#### ***Saving money in our schools***

There are over 2,000 high school campuses in California and thousands more elementary and middle schools.<sup>43</sup> School buildings account for about 12 percent of commercial energy use in California, and over 70 percent of these buildings are over 25 years old. In addition, California schools spend \$700 million a year - nearly three percent of their total budget - on energy.<sup>44</sup> By improving energy efficiency in our schools using AB 32 proceeds, schools can cut energy bills by 20 percent to 40 percent, leaving money for other educational priorities.

Cost-effective energy efficiency upgrades can help schools save on their energy bills and return that money to the classroom. These improvements include well-established solutions such as lighting, windows, and HVAC retrofits as well as distributed renewable energy generation. A research study conducted by Lawrence Berkeley National Laboratory found that upgrading HVAC units in relocatable classrooms could reduce the energy

needed for HVAC by 50 to 70 percent, while improving air quality for California's students and teachers.<sup>45</sup>

In addition to needing basic efficiency upgrades, schools face a common challenge in lowering electricity usage through energy-saving behaviors. Since the cost of utilities is often passed on to the district, the individuals with the most access to energy savings, school personnel, do not necessarily have the incentive to implement the savings. Finding solutions to this problem could have a tremendous impact on emissions and costs.

One solution developed and implemented by the San Francisco Unified School District is a *Shared Savings Plan* that encourages and rewards schools that successfully reduce their utility bills through the implementation of a district-wide coordinated plan. Through small amounts of initial funding, individuals on each campus become environmental coordinators to manage energy savings, and individual schools receive half of the savings that are generated. The stipend for the coordinator in future years is taken from the school's savings, allowing the program to continue without any future capital investment. Several pilot schools within this program were able to reduce their utility use by 30 percent in a single year.<sup>46</sup>

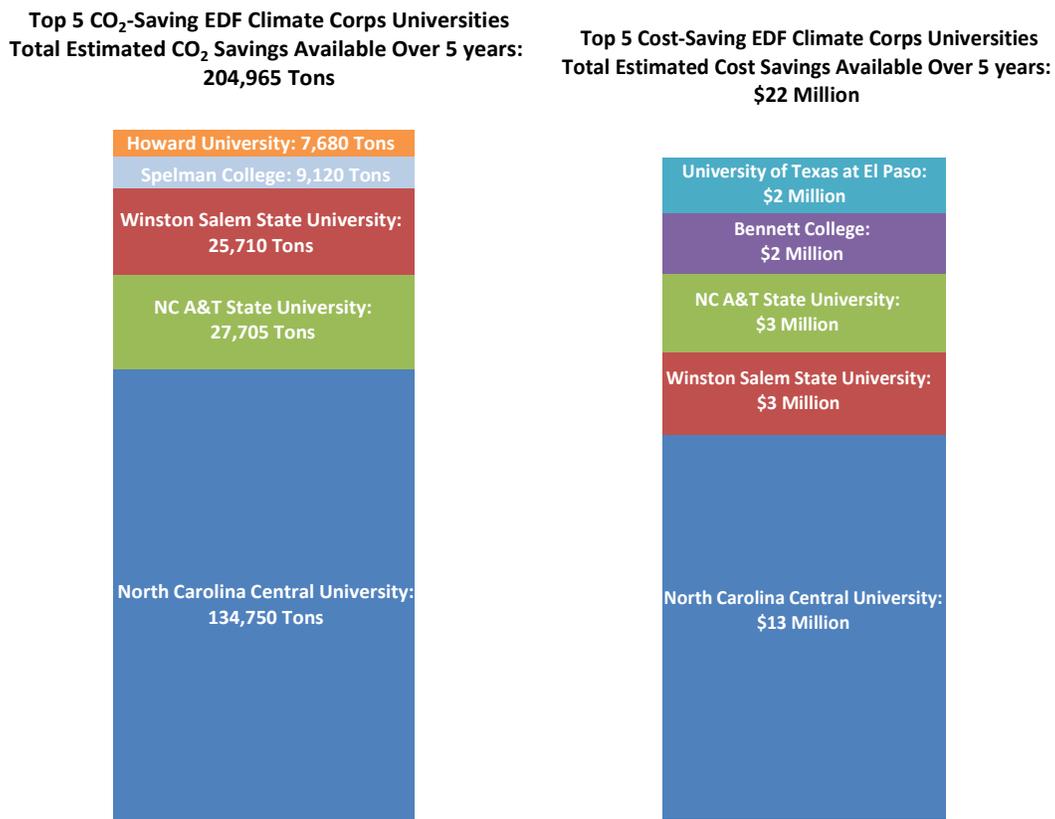
## ***Generating savings for universities***

Proceeds from the AB 32 program could also assist California's colleges and universities to study, initiate, or undertake measures that reduce their energy purchases, direct on-site emissions, and overall operations costs. Accordingly, since public colleges and universities receive operations budgets from the state, and energy purchases (electricity and natural gas) are funded through this budget, pursuing investments to cut these expenditures also makes one-to-one reductions from statewide spending needs. When colleges or universities are able to cut these operations budgets, more funding is directed to areas within the core business framework, making the education system more accessible and rewarding for students.

One clear example of the ready-made investment potential for AB 32 proceeds is the University of California. Every year the UC system consumes 250 MW of electricity, which is similar to that of a medium-sized city.<sup>47</sup> To manage this need, the UC system has created system-wide and individual campus *Strategic Energy Plans* that detail potential energy efficiency savings.<sup>48</sup> Savings from current efficiency projects on UC campuses since 2004 total 230 million kWh and approximately 168,000 MTCO<sub>2e</sub> per year. These projects are expected to save about \$32 million per year. While the UC system has already implemented some of the most cost-effective, near-term energy efficiency measures on its

campuses, the UCs can realize even farther savings: the administration has identified \$480 million of efficiency projects that will result in energy savings in excess of 50 percent.<sup>49</sup>

State universities are a significant investment opportunity for AB 32 proceeds. Another example of this can be learned from the results of the EDF Climate Corps program on college and university campuses across the country. From the five universities with the biggest potential savings identified in 2010, EDF Climate Corps found reductions of \$20 million in energy costs and more than 200,000 tons of carbon dioxide emissions available over the next five years.



Source: EDF Climate Corps (2010)

## ***Making hospitals more efficient***

Hospitals are among the most energy intensive buildings in the U.S. National hospital energy bills total more than \$5 billion and often equal 1 to 3 percent of a hospital's operating budget or an estimated 15 percent of profits.<sup>50</sup> Although hospitals require special equipment that results in high energy use, and must be run around the clock,

experts agree that steps can be taken to reduce energy use and produce cost savings for hospitals.<sup>51</sup> For example, some energy auditors for hospitals report finding 10 to 40 percent energy savings on routine evaluations when taking into account capital investment opportunities.<sup>52</sup> To illustrate the importance of cutting costs at hospitals, the Hospital Energy Initiative reports that every \$1 saved on energy is equivalent to generating \$20 in new revenues for hospitals or \$10 for medical offices,<sup>53</sup> and these savings can be directed to improving patient care. Accordingly, AB 32 investments in the roughly 500 hospitals in California can result in significant savings and improved patient care.

Another example of the efficiency improvements available at hospitals is EDF Climate Corps' work with the Hospital Corporation of America (HCA) to develop a lighting retrofit program. Upgrading the lighting in most of HCA's 160 hospitals will save the company 82 million kilowatt hours of electricity per year, avoiding 52,000 metric tons of CO<sub>2</sub> emissions annually and \$14.7 million in net operating costs over the project's lifetime.<sup>54</sup>

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<sup>1</sup> GLOBE Advisors and The Center for Climate Strategies. March 2012. "The West Coast Clean Economy: Opportunities for Investment & Accelerated Job Creation." Report commissioned by the Pacific Coast Collaborative. Available at [www.climatestrategies.us/library/library/download/972](http://www.climatestrategies.us/library/library/download/972)

<sup>2</sup> Bureau of Labor Statistics. April 2012. Unemployment Rates for States. Available at <http://www.bls.gov/web/laus/laumstrk.htm>

<sup>3</sup> Collaborative Economics. May 2012. "Seven Growth Sectors Driving California's Clean and Efficiency Economy," San Francisco, CA: Environmental Defense Fund. Available at <http://www.edf.org/sevensectors>

<sup>4</sup> Ibid.

<sup>5</sup> Environmental Business International, Inc. February 2011. "The Clean Energy Industry in California: An Economic Analysis Assessing the Current Market in the Global Economy." Prepared for the California Air Resources Board. Available at <http://www.arb.ca.gov/research/apr/past/07-315.pdf>

<sup>6</sup> GLOBE Advisors and The Center for Climate Strategies. March 2012.

<sup>7</sup> Collaborative Economics. May 2012

<sup>8</sup> Cleantech Group-Heslin Rothernberg Farley & Mesiti P.C. 2012. "Clean Energy Patent Growth Index (CEPGI): 2011 Year in Review." Available at <http://cepgi.typepad.com/files/cepgi-4th-quarter-2011-2.pdf>

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<sup>10</sup> Wyden, Sen. Ron. 2012. "Losing the Environmental Goods Economy to China." Available at <http://www.wyden.senate.gov/>

<sup>11</sup> According to Cleantech Group's i3 Platform, total 2011 investments were \$3.7 billion, an increase of 25% from 2010's level of \$3 billion. Compound Annual Growth Rate (CAGR) is a smoothed annualized gain in investment. To calculate CAGR, the total percentage of growth is found over a period of time and then put to the  $n^{\text{th}}$  root, where  $n$  is one over the number of years in the period of time being considered. Available at <http://research.cleantech.com/>

<sup>12</sup> Gereffi, G., Dubay, K. and Lowe, M. November 2008. "Manufacturing Climate Solutions: Carbon-Reducing Technologies and U.S. Jobs." Center on Globalization, Governance & Competitiveness, Duke University. Available at <http://www.cggc.duke.edu/environment/climatesolutions>.

<sup>13</sup> An analysis of the Regional Greenhouse Gas Initiative, the Northeast's regional cap-and-trade program, found that RGGI's investment of \$912 million in allowance proceeds resulted in \$1.6 billion gain in economic value and \$1.3 billion in energy savings to consumers in the ten-state region. See The Analysis Group. November 2011. "The Economic Impacts of the Regional Greenhouse Gas Initiative on Ten Northeast and Mid-Atlantic States: Review of the Use of RGGI Auction Proceeds from the First Three-Year Compliance Period." Available at <http://www.analysisgroup.com/RGGI.aspx>

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<sup>14</sup> California Air Resources Board. Status of Scoping Plan Measures of the California Global Warming Solutions Act of 2006. Available at [http://www.arb.ca.gov/cc/scopingplan/status\\_of\\_scoping\\_plan\\_measures.pdf](http://www.arb.ca.gov/cc/scopingplan/status_of_scoping_plan_measures.pdf)

<sup>15</sup> See for example Cifuentes, L., Borja-Aburto, V., Gouveia, N., Thurston, G., and Davis, D.L. August 2001. "Hidden Health Benefits of Greenhouse Gas Mitigation." *Science*, 17: 293 (5533), 1257-1259; U.S. EPA. September 2011. "Assessing the Multiple Benefits of Clean Energy: A Resource for States." Available at <http://www.epa.gov/statelocalclimate/resources/benefits.html>

<sup>16</sup> US EPA. March 2012. Currently Designated Nonattainment Areas for All Criteria Pollutants. Green Book, Available at <http://www.epa.gov/oaqps001/greenbk/ancl.html>

<sup>17</sup> Fann, N., Lamson, A. D., Anenberg, S. C., Wesson, K., Risley, D. and Hubbell, B. J. 2012. "Estimating the National Public Health Burden Associated with Exposure to Ambient PM<sub>2.5</sub> and Ozone." *Risk Analysis*, 32: 81-95.

<sup>18</sup> U.S. EPA. Effects of Air Pollutants – Health Effects. Available at <http://www.epa.gov/apti/course422/ap7a.html>.

<sup>19</sup> Grant, Y. and Shaw, J. April 2012. Unmet Transit Funding Needs in California: FY2011-2020. Ninth National Conference of Transportation Asset Management.

<sup>20</sup> California Energy Almanac. California's Major Sources of Energy, 2011. Available at [http://energyalmanac.ca.gov/overview/energy\\_sources.html](http://energyalmanac.ca.gov/overview/energy_sources.html)

<sup>21</sup> Department of Energy Industrial Assessment Center Database. Excludes savings from load shifting from peak to non-peak usage.

<sup>22</sup> California Public Utilities Commission Decision D.12.05.015. May 2012. Available at [http://docs.cpuc.ca.gov/PUBLISHED/FINAL\\_DECISION/166830.htm](http://docs.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/166830.htm).

<sup>23</sup> Annual savings information from <http://www.edfclimatecorps.org/organizations>

<sup>24</sup> Institute for Building Efficiency. 2012. "Energy Efficiency Indicator Survey: U.S./Canada Results." Available at <http://www.institutebe.com/Energy-Efficiency-Indicator/2012-EEI-US-Canada-Results.aspx?lang=en-US>

<sup>25</sup> While there are many options for investment of AB 32 cap and trade auction to cut pollution and grow California's economy, the types of investments profiled represent a set of strategies that will capitalize on the state's existing infrastructure of clean economy companies. Accordingly, this list is not meant to dismiss the potential value or opportunity of other investment strategies that have not been evaluated.

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<sup>28</sup> Harcourt Brown & Carey, Inc. 2011. p. 47.

<sup>29</sup> Institute for Building Efficiency. 2012. See endnote 24

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- <sup>43</sup> California Department of Education (CBEDS, DataQuest, and Public School Directory). May 2005. Data on Enrollment Projections: California Department of Finance, California Public K-12 Enrollment and High School Graduate Projection by County. 2004 Series.
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<sup>52</sup> Interview with Mike Hatten. Available at <http://www.betterbricks.com/healthcare/industry-expert-shares-advice-energy-savings-and-smart-hospital-operation>

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